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THE NEWTONIAN SYSTEM OF THE WORLD, THE BEST Model of Government: An *Allegorical* POEM.

Foxon D.3

With a plain and intelligible Account of the Syſtem of the World, by Way of *Annotations*:
With COPPER PLATES:

To which is added,

CAMBRIA's Complaint
Againſt the *Intercalary* Day in the Leap-Year.

By J. T. DESAGULIERS, L L. D. Chaplain to His Grace the Duke of CHANDOS, and F. R. S.

WESTMINSTER:
Printed by A. CAMPBELL, for J. ROBERTS in *Warwick Lane*; and
Sold by the Bookſellers of *London* and *Weſtminſter*. 1728.
(Price 1 *s.* 6 *d.*)

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To the RIGHT HONOURABLE
The EARL of *ILAY*, &c, &c, &c.

MY LORD,

THO' I never made *Politicks* my Study, but always thought it my Duty rather to take Care to be obedient my ſelf, than to look into the Management of my Superiors; yet, among my Philoſophical Enquiries, I have conſider'd *Government* as a *Phænomenon*, and look'd upon that Form of it to be moſt perfect, which did moſt nearly reſemble the Natural Government of our *Syſtem*, according to the Laws ſettled by the *All-wiſe* and *Almighty Architect* of the Univerſe.

THOSE Philoſophers who wanted Obſervations and Mathematicks, or wou'd not make Uſe of them, have given us ſuch incoherent *Hypotheſes* concerning Cæleſtial Appearances, and the Cauſes of the Motions of the heavenly Bodies; that the very worſt Form of Government cannot be ſo inconvenient to thoſe who live under it, as the wild Notions of ſuch Philoſophers are ſhocking to unprejudic'd Reaſon and common Senſe.

BUT when the incomparable Sir *Iſaac Newton* gives us Facts and Demonſtrations, inſtead of Suppoſitions and Conjectures, how is the Mind charm'd with the Beauty of the Syſtem? What Traces of Divine Wiſdom do we ſee in the moſt regular Action of univerſal *Gravity*, (or Attraction) whoſe Power is diffus'd from the Sun to the very Centers of all the Planets and Comets, and acts upon the moſt diſtant of thoſe Bodies, in as mathematical a Manner as it does upon the neareſt? How wonder-

wonderfully does it bring back the Comets from their immenſly diſtant *Aphelion*, in their very long Ellipſes, by the ſame Laws that it keeps the neareſt Planet *Mercury* in its Orbit: The former deſcribing *equal Areas in equal Times* round the Sun, as regularly as the latter, whilſt Gravity always checks the Projectile Force, (whereby the Bodies tend to fly from the Sun) in Proportion to the Quantity of that Force.

THE *limited Monarchy*, whereby our Liberties, Rights, and Privileges are ſo well ſecured to us, as to make us happier than all the Nations round about us, ſeems to be a lively Image of our Syſtem; and the Happineſs that we enjoy under *His* preſent MAJESTY's Government, makes us ſenſible, that *ATTRACTION* is now as univerſal in the Political, as the Philoſophical World.

YOUR LORDSHIP's conſummate Knowledge of the *Laws of Nature* which are eſtabliſh'd in the Heavens, as well as that of the *Laws of Nations*, and particularly thoſe of *Great Britain*, makes the Patronage of this Poem Your undoubted Right.

YOUR Lordſhip can beſt judge, whether the *Allegory* be juſt; and it is by Your Lordſhip's Approbation that I deſire to ſtand or fall: Only begging, that the Truth of the Philoſophy may excuſe the Badneſs of the Poetry.

INSTEAD of attempting Your Lordſhip's Character, which wou'd require an abler Pen than mine, and even then offend Your Lordſhip, by doing Juſtice to Your Merits; I ſhall only beg Leave to return my humble Thanks for the Freedom and Goodneſs with which Your Lordſhip has always receiv'd me; and tho' Your Lordſhip is pleas'd to lay aſide Your Qualiy in Condeſcenſion o me, I ſhall always be ſenſible how great an Honour is conferr'd on,

MY LORD,

Your Lordſhip's

moſt oblig'd and

moſt humble Servant,

J. T. D.

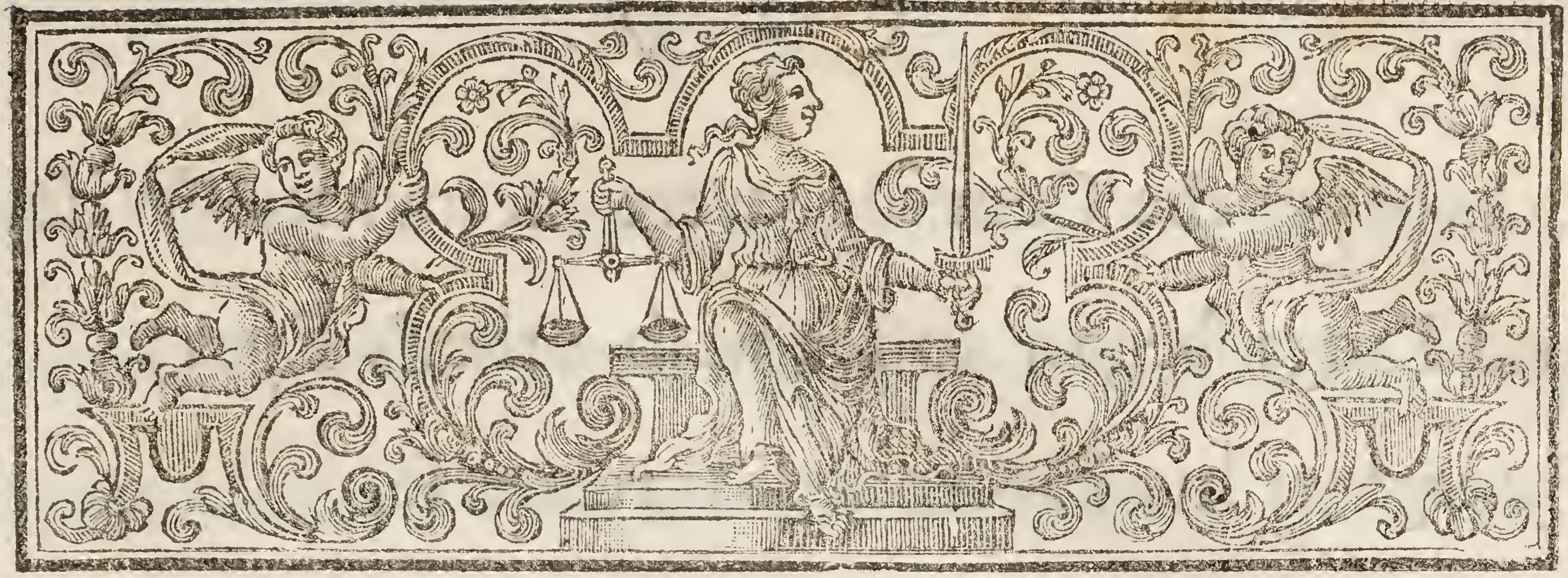
PREFACE.

THE Univerſal Joy that fill'd all *Engliſh* Hearts at His preſent MAJESTY's Acceſſion to the Throne, had ſo ſtrong an Effect upon me, as to draw me from the ſerious and rugged Reſearches of *Philoſophy*, to the lighter and more agreeable Amuſement of *Poetry*.

THUS influenc'd, I was reſolv'd to endeavour at ſomething that might at once ſhew my Zeal and Loyalty, and at the ſame Time divert Her moſt Gracious Majeſty with my firſt Poetical Experiment, as I have had the great Honour of entertaining Her with Philoſophical ones. The following Poem was wrote laſt Summer, and intended to be publiſh'd on the Day of the *Coronation* : But when I conſider'd that ſeveral Aſtronomical Terms and Alluſions wou'd want explaining to ſuch Readers as had not been converſant in the Cœleſtial Science, I reſolv'd to add a few Notes, tho' they were not neceſſary to thoſe Great Perſons, for whom my Poem was chiefly deſign'd. Then again, remembring that it is a common Saying, that *Philoſophers are the worſt of Poets*, and yet, being unwilling to ſuppreſs the firſt Offspring of my Muſe, I enlarg'd my Annotations, and illuſtrated them with Copper Plates, ſo as to give a full Account of the Syſtem of the World, in a plain, and intelligible Manner, together with a Confutation of thoſe falſe *Hypotheſes* which have ſometimes obtain'd among learned Men. Thus have I *tack'd* my Poetry to Philoſophy, to make it go down; and tho' it ſhou'd be thrown out by a *Majority*, I hope, by this Expedient, to gain a ſufficient Number to keep it from being waſte Paper.

CAMBRIA's Complaint was written ſince the Aſtronomical Poem was in the Preſs.

WHEN I conſider'd the *Firſt of March*, as my own *Birth-Day*, I was indeed diſpleas'd at the *Intercalary* Day, which puts it off once in four Years, but bore it with Patience, becauſe the *Biſſextile* was ſettled by Aſtronomers; but as it is *Her Sacred* MAJESTY's *Birth-Day*, and thus delay'd in the firſt Year of Her Reign, I cou'd no longer bear it; and therefore, to revenge the Affront offer'd to the ROYAL CONSORT by an intruding Day, I invok'd the Muſe to complain, in the Perſon of *Cambria*, with all the Wrath and juſt Reſentment, becoming the tutelar Goddeſs of that Principality.



THE NEWTONIAN SYSTEM *of the* World THE BEST *MODEL* of *Government.*

AN *Allegorical* POEM.

IN Ancient Times, ere Bribery began
To taint the Heart of undeſigning Man,
Ere Juſtice yielded to be bought and ſold,
When Senators were made by Choice, not Gold,

5. Ere yet the Cunning were accounted Wiſe,
And Kings began to ſee with other's Eyes;
Pythagoras his Precepts did rehearſe,
And taught the Syſtem of the Univerſe;
Altho' the Obſervations then were few,
10. Juſt were his Reaſonings, his Conjectures true:

Men's

VERSE 8. *And taught the Syſtem of the Univerſe*;

THE Syſtem of the Univerſe, as taught by *Pythagoras*, *Philolaus*, and others of the Ancients, is the ſame, which was ſince reviv'd by *Copernicus*, allow'd by all the unprejudic'd of the Moderns, and at laſt demonſtrated by Sir *Iſaac Newton*. The firſt Figure will give a clear Idea of it. All the Difference between the modern and ancient Syſtem, is only what is added to it ſince the Invention of the Teleſcope, viz. *The four Satellites, or Moons of* JUPITER, *diſcover'd by* Galilœo: *The Ring of* SATURN (*a thin flat Body encompaſſing it without touching*) *and one of his Satellites diſcover'd by* Huygens, *and the other four Satellites of that Planet firſt ſeen by* Caſſini; *the* Phaſes *of* VENUS *and* MERCURY, *like thoſe of the Moon*, theſe Planets appearing *full*, when they are beyond the *Sun*, *halv'd* when at their greateſt apparent Diſtance (or *Elongation*) from the Sun, as at the Points *P*, *Q*; (*Fig*. 1.) and *horned*, as they paſs between the Sun and the Earth, not directly in a Line with the Centre of the Earth and Sun; becauſe, then they loſe all their Light in Reſpect of us, and appear like black Spots paſſing acroſs the Sun's Face, or *Diſk*, as VENUS is drawn in this Figure. *Laſtly*, The Orbit of a Comet, which was firſt ſettled by Sir *Iſaac Newton*, who has given us a Method from three Obſervations to determine the Path of a Comet, ſo as to be able to know where a Comet will paſs as long as it is viſible; how near it will go to the Sun; with what encreaſing Velocity it will approach towards it; and with what decreaſing Velocity it will recede from it,

after

Men's Minds he from their Prepoſſeſſions won,
Taught that the Earth a double Courſe did run,
Diurnal round it ſelf, and *Annu'al* round the Sun,
That the bright Globe, from his Æthereal Throne,
With Rays diffuſive on the Planets ſhone,
And, whilſt they all revolv'd, was fix'd alone.
What made the Planets in ſuch Order move,
He ſaid, was Harmony and mutual Love.
The Muſick of his Spheres did repreſent
That ancient Harmony of Government:

---

after it has paſs'd by it. Dr. *Halley* has ſettled the whole Time of the Revolution of ſome of the Comets, ſo as to be able to foretel their Return, and to deſcribe that remaining Part of their Orbit, in which they are inviſible by Reaſon of their great Diſtance from the Sun which enlightens, and from us who ſhould ſee them.

VERSE 19. *The Muſick of his Spheres did repreſent.*

THE Harmonical Proportion, which *Pythagoras* obſerv'd to obtain in the Motion of the Heavenly Bodies, was taken to be real Muſick by the Ignorant; who fancy'd, that the Spheres (or hollow Spherical Shells, ſuppos'd

When Kings were not ambitious yet to gain
Other's Dominions, but their own maintain;
When, to protect, they only bore the Sway,
And Love, not Fear, taught Subjects to obey.
But when the Luſt of Pow'r and Gold began
With Fury, to invade the Breaſt of Man,
Princes grew fond of arbitrary Sway,
And to each lawleſs Paſſion giving Way,
Strove not to merit Heaven, but Earth poſſeſs'd,
And cruſh'd the People whom they ſhould have bleſs'd.
Aſtronomy then took another Face,
Perplex'd with new and falſe *Hypotheſes.*

Uſurping

poſ'd to carry the Planets in them) rubbing againſt one another, produc'd melodious Sounds, but that the Muſick could not be heard, by reaſon of the great Diſtance.

Uſurping *Ptolemy* depos'd the Sun,
And fix'd the Earth unequal to the Throne.
This *Ptolemaick Scheme*, his Scholars ſaw, 35
No way agreed with the *Phœnomena*:

But

VERSE 33. *Uſurping* Ptolemy *depos'd the Sun*, &c.

Ptolemy ſuppos'd the Earth to be in the Center of the World, encompaſs'd with many Orbs or Spheres, one within another. The firſt immediately compaſſing the Earth, he called the Sphere of *Air*, the next the Sphere of *Æther*, then the Sphere of *Fire*: After followed ſeven other Solid Tranſparent Shells, which were ſaid to carry the Planets in them, from Weſt to Eaſt in the following Order, *viz.* the *Moon*, *Mercury*, *Venus*, the *Sun*, *Mars*, *Jupiter*, and *Saturn*; then a Sphere called the *Primum Mobile* (or firſt Mover) encompaſſing all, and ſuppoſed to carry the whole Machine of the Univerſe round from Eaſt to Weſt, in 24 Hours, without diſturbing the particular Motions of each Sphere. But afterwards for ſolving ſome apparent Motions in the Heavens, not taken notice of before, the Followers of *Ptolemy* contrived three other Spheres or *Heavens*, between *Saturn*'s Heaven and the *Primum Mobile*, which he calls the Firſt, Second, and Third *Chryſtalline*.

The ſecond Figure repreſents the Ptolemaick Syſtem, *wherein we have omitted the three* Chryſtallines, *and the* Spheres *of* Air, Æther *and* Fire, *to avoid Confuſion.*

But yet reſolv'd that Syſtem ſhould obtain,
Us'd all their Arts his Tenets to maintain;
A Revolution in the Earth to ſhun,
40. Immenſe Velocity they gave the Sun;

Then

VERSE 37. *But yet reſolv'd that Syſtem ſhould obtain,*
Immenſe Velocity thus gave the Sun

THE *Ptolemaick Syſtem* was very well receiv'd among the Vulgar, and ſuch as were not accuſtom'd to conſider the Difference between *apparent* and *real* Motion. If a Man, who had never ſeen or heard of a Ship, ſhould be carried into the Cabin of a large Man of War with his Eyes blind-folded; and whilſt the Ship was ſailing with a ſteady Motion, ſhould have the Bandage taken off, he would not be ſenſible of his being carried along; but would imagine Rocks, Buoys, and other fixed Objects, which he paſſed by, to be carried the contrary way; and, if he did not reflect, he would think the very Shores, with the Trees, and Houſes, alſo to move. So the unphiloſophical part of Mankind, (who look upon the *Sun* and *Moon* to be but ſmall Bodies, and the Planets and fixed Stars much ſmaller, whilſt they believe the Earth to be immenſly greater, and alone to deſerve the Name of the *World*) cannot conceive their own Habitation to move, but look upon ſuch as aſſert it to be ridiculouſly whimſical, or to deſign to impoſe upon Mankind with a Cant of hard Words, and out of the way Notions. But when *Aſtronomers* found by the *Sun*'s great Diſtance and apparent Magnitude, that he muſt be far greater than the Earth, ; then they thought it, (at leaſt) as reaſonable to ſolve the Appearances of Day and Night, and of the Seaſons by attributing two ~~the~~ Motions to the Earth, One about its *Axis* in twenty four Hours to explain the firſt, and another about the Sun in a Year to account for the laſt. But ſuch as would always have the Holy Scriptures taken in a literal Senſe (as if the *Divine Revelation*, which was given us to teach us Morality, and our Articles of Faith, had alſo been intended to inſtruct us in Philoſophy)

Then *Solid Orbs* with ſtrain'd Invention found,
To ſhew how *Planets* might be carry'd round.

But

loſophy) quoting ſeveral Paſſages to diſprove the Motion of the Earth, declared it *Hereſy* to aſſert that it moved; and therefore choſe rather to quit the greater Probability, and find Expedients to maintain the contrary Opinion. For the Objection againſt the Motion of the Earth, by Reaſon of its Weight and Bulk, vaniſhes at once when we conſider that the Sun is about ten Hundred Thouſand times bigger, and above two Hundred Thouſand times heavier; and that, to produce only the Different Seaſons, it muſt, in the Space of one Year, run through an Orbit whoſe Semidiameter is above eighty Millions of Miles long; but when Day and Night come to be conſidered, then the Sun muſt be ſuppoſed to run through that whole Orbit in twenty four Hours, which is a Motion incredibly ſwift, being three Hundred and ſixty five times ſwifter than the Annual Motion of the Earth, or 540666 Miles in one Minute, which is 25200 Times ſwifter than a Cannon Ball: Whereas a Revolution of the Earth about its *Axis* in 24 Hours, will as clearly explain that *Phænomenon*.

THE Syſtem of *Tycho Brahe*, who ſuppoſes all the Planets except the *Earth* and *Moon* to Move round the *Sun*, and yet that the vaſt *Sun* with all of them revolving about him is carried round our little Globe of Earth, is ſo abſurd, that the bare ſight of the Scheme (*Figure* 3d) is enough to confute that Suppoſition. Neither have I made any mention of it in the POEM; becauſe we can never ſuppoſe any Thing to have happened in any Government ſo improbable, as that a Powerful *Sun* ſhould be ſo far influenced by a *Planet* as to be carried about at his Pleaſure; when at the ſame time the other great Officers move regularly in their Orbits, eſpecially when they have *Mars* amongſt them.

But when th' Obſervers, who the Heav'ns ſurvey'd,
Perceiv'd the *Planets* ſometimes *retrograde*,
Sometimes *directly* mov'd with *haſty Pace*,
Sometimes more *ſlow*, then *ſtopping* in their Race,

For

VERSE 44. *Perceiv'd the* Planets *ſometimes* retrograde,
Sometimes directly *mov'd with haſty Pace*,
Sometimes more ſlow, *then* ſtopping *in their Race*, &c.

THE Planets, in reality, are always direct; that is, Move according to the Order of the Signs, running through the *Conſtellations* from *Aries* to *Taurus*, and ſo on through *Gemini*, *Cancer*, &c. but by reaſon that the Obſerver is carried along with the Earth on which he ſtands, whilſt he is inſenſible of his own Motion, the *Planets* appear to him to go ſometimes *backward* among the *fix'd Stars*, and ſometimes to go much *faſter*, then much *ſlower*, and alſo now and then to *ſtand ſtill*, (that is to keep the ſame apparent Diſtance in reſpect to the *fixed Stars* about them) in which different Caſes they are ſaid to be either *Direct*, *Retrograde* or *Stationary*, as may be ſeen in *Fig*. 4 and 5.

THE 4th *Figure* ſhews the apparent Irregularity of *Mars*'s Motion, which will ſerve to explain the Cauſe of thoſe Appearances in the other two ſuperior Planets, *viz*. *Jupiter* and *Saturn*.

BUT for the ſake of ſuch Readers as are wholly unacquainted with *Aſtronomy*, I beg leave to begin with the Explication of ſome Things neceſſary to be known, before I conſider theſe *Stations* and *Retrogradations*, &c.

WHEN we look out in a clear Night, we may diſtinguiſh the *Planets* from the *fixed Stars* by their not twinkling as the *fixed Stars* do, (or what is more certain) by the *Teleſcope*, which will magnifie them, whilſt the

fix'd

For this, Expedients muſt invented be,
That, with it ſelf, their Syſtem may agree,
And keep ſome ſhew of Probability.

fix'd Stars are not magnified, but rather diminiſhed by it. The Obſervations of one Night or two only ſhew us ſuch *Planets* as we then ſee together with the *fixed Stars* about them riſing in the Eaſt, getting to their greateſt Height in the South, and ſetting in the Weſt, as we ſee the *Sun* do in the Day time, and the *Moon* thoſe Nights when it ſhines.

THIS ſeems to be performed by a Motion of the whole Concave of the Heavens in 24 Hours, call'd by *Ptolemy* the Motion of the firſt Mover (*Primum Mobile*) but that Motion is only ſuch apparently; for it is the Revolution of the Earth about its own Center the contrary way, (*viz.*) from Weſt to Eaſt) in the ſame Time, which cauſes the Appearance of Riſing and Setting, in the Heavenly Bodies.

NOW when we come to take notice of the *Moon*, or any other of the *Planets* for ſeveral Nights ſucceſſively, we find that thoſe Bodies do not appear to *Riſe* and *Set* and *Move along* with the ſame *Stars*, but *creep on ſoftly* towards the Eaſt, ſo as to Riſe and Set later than the *Stars* which they accompanied before. This is called the *Proper Motion* of the *Planets*, and is owing to their revolving about the *Sun*, in Orbits that are nearly circular, which Revolution they always perform in a certain Period of Time, *viz. Mercury* in 87 Days, or near three Months; *Venus* in 224 Days, or a little more than ſeven Months; the *Earth* (which makes the *Sun* ſeem to move juſt in the ſame Manner) in a Year; *Jupiter* in almoſt twelve Years, and *Saturn* in almoſt Thirty; and the *Moon* moves about the Earth in twenty ſeven Days, and about ſeven Hours.

IF an Obſerver were removed from the Earth, to the *Center* of the *Sun*, and ſuppoſed to have the Proſpect of the Heavens from thence, he

Within their thicken'd Orbs new Orbs they made,
Each *Deferent* its *Epicycle* had,
So round the Earth the *Planets* ſtill convey'd.

Wheels

would ſee all the *fix'd Stars* in the ſame Order, and of the ſame apparent *Magnitude* as we ſee them from the Earth; for though the Diſtance from us to the *Sun* is above 80 Millions of Miles, yet all that Diſtance is but as a Point when compared with the Diſtance of *fix'd Stars*.

Now ſuch an Obſerver would loſe ſight of what we call the *Diurnal Motion*, and only behold the *Planets* ſhifting their Places among the *fix'd Stars* in regular Orbits, or Ovals nearly circular, which though different from one another, yet all of them have the *Sun* for their Center (or rather, in Terms of Art, the *Sun* is in one of the two *Foci* of thoſe Orbits) and take up but a very ſmall Breadth in the Heavens, which Breadth or Belt is called the *Zodiac*.

If a Line be ſuppoſed to be drawn from the Obſerver's Eye, through the Center of the *Planet*, quite to the *fix'd Stars*, the Place where that Line terminates among the *fix'd Stars* is called *the Place of the Planet* ----*Heliocentrick* Place, if the Obſerver be ſuppoſed in the Center of the and *Sun*; *Geocentrick*Place, ſuppoſing the Obſerver in the Center of the Earth. If the *Planets* were near the *fix'd Stars*, vaſtly diſtant both from the *Sun* and the Earth, the *Heliocentrick* and *Geocentrick* Places would always be nearly the ſame; but as they are very near the *Sun*, and one another, in compariſon of the Diſtance of the *fix'd Stars* (*Saturn* the moſt remote not being 10 times farther from the *Sun*, than the Earth) the *Heliocentrick* and *Geocentrick* Place of the *Planets* muſt differ very much ſometimes, and never be preciſely the ſame, but when the *Sun*, *Earth* and *Planet*, have their three Centers directly in a Line.

SINCE

Wheels within Wheels complex'd, they thus involve,
And yet Appearances but falſely ſolve.

Since then, as I have already ſaid, the *Planets* if ſeen from the *Sun*, would appear to move perfectly regular (only appearing to be largeſt in their *Perihelion*, or when neareſt the *Sun*; and leaſt in their *Aphelion*, or when fartheſt from it) it is plain that as we ſee them from the *Earth*, the ſhifting of the Obſerver's Place, as well as that of the *Planet*, muſt give their regular Motion very irregular Appearances: Accordingly *Aſtronomers*, when they came more nicely to obſerve the *proper* Motion of the *Planets*, found that as they went Eaſtwards among the *fix'd Stars*, they mov'd ſometimes faſter, and ſometimes ſlower; that they ſometimes continued in the ſame Place, (that is roſe, ſet, and appeared to be carried among the ſame Stars) for ſome Days; nay, that ſometimes they moved towards the Weſt among the Stars, and therefore ſaid that the *Planets* were *Direct*, *Stationary* and *Retrograde*; whilſt the *Moon* (becauſe it does really move round the Earth) has none of thoſe Appearances.

This gave a great Shock to thoſe who believed the Earth to be fixed in the Center of the World; but it is eaſily accounted for, when once the *Diurnal* and *Annual* Motion of the Earth are allowed. For Example, Let us ſuppoſe *Mars (Fig. 4.)* to be at *B*, and to move from Weſt to Eaſt, that is from *B*, to *D*, *E*, *K*, *P*, &c. If ſeen from the *Sun*, *Mars* will appear among the *fix'd Stars*, to move according to the Order of the Signs, *viz.* from ♎ to ♏, ♐, and ſo on to ♑, ♒, *&c.* through the twelve Parts of the *Zodiac* diſtinguiſhed by the ſaid Signs or Characters, in a very regular Manner; but the Appearances will be quite otherwiſe, when that *Planet* is ſeen from the Earth. The Earth being at *A*, and *Mars* at *B*, *Mars* will appear at ♎ among the *fix'd Stars*, the *Heliocentrick* and *Geocentrick* Place being the ſame; but when the Earth has moved from *A* to *o*, as *Mars* moves ſlower than the Earth, he will only move from

B to *D*, and (ſeen from the *Sun*) ſhift his Place from ♎ to ♏ through the *Arc* ♎ ♏, but ſeen from the Earth it will appear to have gone faſter, *viz.* through the *Arc* ♎ 1 : then when the Earth is got to *E*, *Mars* will only be got to *F*, its *Heliocentric* Place being *a*, as it has deſcrib'd among the *fix'd Stars* the *Arc* ♏ *a* ; but its *Geocentrick* Place is 2, and (ſeen from the Earth) it will appear to have moved much faſter deſcribing the *Arc* 1 2.

WHILST the Earth moves from *E* to *G*, *Mars* will move from *F* to *H*, its *Heliocentrick* Motion, (which is uniform) being from *a* to *b*; but ſeen from the Earth, it has not appeared to move at all but has been *Stationary* in its *Geocentrick* Place 2.

AS the Earth moves from *G*, through *I*, to *L*, *Mars* in his Orbit moves from *H*, through *K*, to *M*, deſcribing among the *fix'd Stars* by its *Heliocentrick* Motion the *Arc b c* ; but ſeen from the Earth, it will appear to have deſcribed the *Arc* 2 3. by a *Retrograde Motion*, or contrary to the Order of the Signs, that is from Eaſt to Weſt.

AND here it is to be obſerved, that in this Motion, when *Mars* was at *K*, and the Earth at *I*, the *Heliocentrick* and *Geocentrick* Place was the ſame, *viz.* at ♑.

AS the Earth goes from *L* to *N*, and *Mars* from *M* to *O*; *Mars* (ſeen from the Earrh) will all the while appear *Stationary* at 3, though its *Heliocentrick* Motion has been from *c* to *d*.

LASTLY, as the Earth moves from *N* to *A*, while *Mars* goes from *O* to *P*, and its *Heliocentrick* Motion is from *c* to *d*, the *Planet* (ſeen from the Earth) does again become direct, and ſeems to move from 3 to 4, and ſo on.

IT will not be improper to ſhew here, how the *Sun*, as it is ſeen from the Earth, appears to deſcribe the ſame Orbit, that the Earth doth really deſcribe, without *Stations*, or *Retrogradations*.

WHEN the Earth is in *R* (its *Heliocentrick* Place being in ♎) the *Sun* appears to be in ♈ ; and as the Earth goes through the Points *l*, *m*, *I*, *K*, *N*, *A*, *e*, *o*, *f*, *g*, *h*, *R*, in its Orbit (its *Heliocentrick* Place moving according to the Order of the Signs) the *Sun*'s Place will alſo go thro' the

the Points ♈, ♉, ♊, ♋, ♌, ♍, ♎, ♏, ♐, ♑, ♒, ♓, likewiſe according to the Order of the Signs, but always appearing in the Sign oppoſite to that in which the Earth is.

IF it be asked how we know the *Sun* to be in ſuch and ſuch Signs, ſince we cannot ſee the *fix'd Stars* by Day; we anſwer, that, that Part of the Heavens which we ſee in the South at Midnight is directly oppoſite to that Part in which the *Sun* has appeared at Noon, as might have been perceiv'd if there had been a total Eclipſe, or we had made uſe of a long *Teleſcope* in a dark Room, to ſee the *Stars* that were about the *Sun*. As for Example, If an Obſerver in the enlightened Part of the Earth at *R*, cannot (by reaſon of the great Light of the *Sun)* ſee the *Stars* of *Aries* (♈) when the *Sun* is in that *Conſtellation*; the ſame Obſerver will be carried to *q* at Midnight, by half a Turn of the Earth upon its *Axis*, from whence ſeeing *Libra* (♎) in the South, he will judge with certainty that the *Sun* is then in *Aries* (♈) the oppoſite Sign.

MERCURY and *Venus* the *inferior Planets*, (ſo called becauſe they are nearer to the *Sun* than the Earth is) have alſo their *Stations* and *Retrogradations*, as ſeen from the Earth, which muſt be explained by a different Scheme. See the 5th *Figure*, where the Appearances of *Mercury* are exhibited; which will ſerve to explain thoſe of *Venus*.

WHEN the Earth is at *A*, and *Mercury* at *a*, that *Planet* appears among the *fix'd Stars* at 1; and as the Earth moves from *A* to *B*, *Mercury* which moves faſter, will go in its Orbit from *a* to *b*, and appear to have mov'd among the *fix'd Stars*, from 1 to 2, according to the Order of the Signs, or from Weſt to Eaſt, being then ſaid to be *Direct*.

WHILST the Earth moves from *B* to *C*, and *Mercury* from *b* to *c*, *Mercury* is *Stationary*, not appearing to move out of the Point 2; but as the Earth moves from *C* to *D*, and *Mercury* from *c* to *d*, it appears to deſcribe the *Arc* 2 ♉ among the *fix'd Stars*, by a Motion from Eaſt to Weſt, or contrary to the Order of the Signs, and therefore it is then *Retrograde*.

AS the Earth moves from *D* to *E*, and *Mercury* from *d* to *e*, it becomes *Stationary* at ♉. Laſtly, as the Earth moves from *E* to *F*, and *Mercu-*

cury from *e* to *f*, *Mercury* does again become *Direct*, appearing to move in the *Arc* ♉ 3, from Weſt to Eaſt.

THE Defenders of the *Ptolemaick Hypotheſis* were ſadly put to it, to give the leaſt probable Account of the *Stations* and *Retrogradations* of the *Planets*. Their Solid Tranſparent Orbs, or Chryſtal Shells, by way of Expedient, they ſuppoſed to be much thicker than was at firſt imagined (ſee *Fig.* 2d.) and within their Thickneſs placed little Circles, call'd *Epicycles*, ſuppoſing the *Planet* to go round in the *Epicycle*, whilſt the Orb call'd a *Deferent* (or *Excentrick* becauſe the Earth was ſuppoſed not to be exactly in its Center) went round from Weſt to Eaſt, carrying round the *Epicycle*, together with the *Planet* moving in it: Only the *Sun*'s and *Moon*'s Orb had no *Epicycle*.

SUPPOSE *Mercury*'s Orb (in this 2d Scheme to move from Weſt to Eaſt, and that *Mercury* being in the *Epicycle* at *A* moves faſter from *A* to *B*, than the *Deferent* carries its *Epicycle*, then *Mercury* will appear *Retrograde*. Whilſt a *Planet* (ſee *Venus*'s Orb) moves in its *Epicycle* from *E* to *F*, it appears *Stationary*; but when it moves from *C* to *D*, (ſee *Mars*'s Orb) it will be *Direct*, and have its greateſt Velocity: And all the *Planets* muſt appear ſmaller in their *Apogee* (or greateſt Diſtance from the Earth) and biggeſt in their *Perigee*, or leaſt Diſtance. But when the Times and Places of the *Stations* and *Retrogradations*, and the different apparent Magnitudes of the *Planets* came to be nicely obſerved; the *Ptolemaicks*, to make their *Hypotheſis* or Suppoſition agree with the Obſervations, were forced to enlarge ſome of their *Epicycles*, ſo as to make a monſtrous Syſtem, eſpecially in regard to *Mars*, where the *Epicycle* muſt be larger than the *Deferent* in order to ſolve the *Phænomena*, or Appearances of that *Planet*.

THESE and other Abſurdities, made King *Alphonſus* ſay to ſome *Aſtronomers*, who were explaining to him the *Ptolemaick Syſtem*----*that, if he had been* GOD, *he would have made the World, in a more plain and ſimple Manner*; which he ſaid rather to ridicule thoſe *Philoſophers*, than out of any Spirit of Prophaneneſs.

Like *Peter*'s Coat, the Syſtem burthen'd grew, 55.
Keeping old Faſhions, adding ſtill the new.
  But when Philoſophers explor'd the Skies,
With *Galilæo*'s new-invented Eyes;
In *Mercury* and *Venus*, then were ſhewn
Phaſes like thoſe of the inconſtant *Moon*: 60.

And

VERSE 55. *Like* Peter'*s Coat, the Syſtem burthen'd grew*
Keeping old Faſhions, adding ſtill the new.

See the Story of Lord *Peter* in Dr. *S---ts* Tale of a Tub.

VERSE 58. *With* Galilæo'*s new-invented Eyes.*

Teleſcopes.

VERSE 60. Phaſes *like thoſe of the inconſtant* Moon.

THE *Phaſes* of *Mercury* and *Venus*, whereby they ſeem *horned*, *halv'd* and *full*, and *Mercury* and *Venus*, appearing as Spots upon the Face of the *Sun*, as they paſs in a direct Line between the *Sun* and *Earth*, and their never being in Oppoſition to the *Sun* (that is on the other Side of the Earth) ſhews that thoſe Bodies do indubitably move round the *Sun*, as has been explained in Annotation to *Verſe* the 8*th*, and ſhewn in the firſt *Figure*.

And, like black Patches, croſſing *Phœbus* Face,
Theſe two inferior Globes were ſeen to paſs;
Which ſhew'd the right of *Sol* to hold the central
Place.
Comets, (no longer *Meteors* to be fear'd,
As threatning Vengeance with their Tail or
Beard.) 65
By Teleſcopes, were, laſting Bodies, prov'd,
Like *Planets,* in revolving Orbits mov'd,

VERSE 64. Comets, *no longer* Meteors *to be fear'd.*

SEE Dr. *Halley's* Verſes on Sir *Iſaac Newton's* Principia. The Third Edition.

Jam patet, horrificis quâ ſit via flexa Cometis;
Jam non miramur barbati Phœnomena Aſtri.

Whoſe Courſe deſtroyed the *Ptolemaick World*,
And all the Chryſtal Orbs in ruin hurl’d;
Prov’d ’em fictitious, as in empty Space they
whirl’d.

So when a Minor King the Scepter Sways,
(Some Kings, alas! are Minors all their Days)
How hard’s the Task, how great muſt be the Pains
For envi’d Regents to direct the Reins?
While jarring Parties rend the ſinking State,
Machines, by Art, muſt bear the tott’ring Weight;
Stateſmen perplex’d, with their Invention rack’t,
One Day make Edicts, and the next retract;
The Coin, to Day, ſhall in its Value riſe,
To morrow, Money ſinks and Credit dies;

One Year the Minds are rais'd by ſpecious Schemes,
The next, are wak'd from all their golden Dreams:
And now th' Expedient is a Foreign War;
And now ſoft Peace can ne'er be bought too dear;
And now the Work is done by Plots and Panick Fear.

But bright *Urania*, heavenly Virgin, ſay,
How th' ancient Syſtem made again its Way;
And, that Conſiſtency might be reſtor'd,
The *Sun* became, once more, the central Lord;
What Praiſes to *Copernicus* are due,
Who gave the Motions, and the Places, true;
But what the Cauſes of thoſe Motions were,
He thought himſelf unable to declare.

Carteſius after, undertook in vain,
By *Vortices,* thoſe Cauſes to explain; 95.
With fertile Brain contriv'd, what ſeem'd to be
An eaſy, probable, Philoſophy;
No conjuring Terms or *Geometrick* Spells;
His gentle Readers might be Beaux and Belles.

VERSE 94. Carteſius *after, undertook, in vain,*
By Vortices, *thoſe Cauſes to explain.*

Carteſius ſaid, that the whole *Mundane* Space was full of Matter; and that in our Syſtem, the *Sun* in revolving upon its *Axis*, carried the *Cæleſtial Matter* about it round in a *Whirl Pool*, or *Vortex (Tourbillon)* which Matter in its Motion carried all the *Planets* round the *Sun*; but that every *Planet* had at the ſame time a ſmall *Vortex* moving about it as it turn'd on its *Axis*, whereby it made ſome of the Bodies about it fall on its Surface, and carried others round. The *Earth*, for Example, and *Jupiter* and *Saturn* (as he ſaid) moved their *Satellites* by their particular *Vortices*.

NOT knowing that Comets returned again or revolved in Orbits, He aſſerted that they were only *Planets* flying from one Syſtem to another, when one great *Vortex* got ground of another; for he gave each *fix'd Star* a *Vortex* and *Planets* to go round it, believing with the reſt of the Modern *Philoſophers* that every *fix'd Star* is a *Sun*. But Sir *Iſaac Newton*, and other *Mathematicians* and Experimental *Philoſophers* have ſhewn the Motion of *Planets* in *Vortices*, to be inconſiſtent with Obſervations and Appearances, and a *Plenum* in Nature to be impoſſible.

In *Plato*'s School none cou'd admitted be,
Unleſs inſtructed in *Geometry*;
But here it might, (nay muſt) aſide be laid,
And Calculations that diſtract the Head.
Thus got his Vogue the Phyſical Romance,
Condemn'd in *England*, but believ'd in *France*;
For the bold *Britons*, who all Tyrants hate,
In Sciences as well as in the State,
Examin'd with experimental Eyes,
The *Vortices* of the *Carteſian* Skies,
Which try'd by Facts and *mathematick* Teſt,
Their inconſiſtent Principles confeſs'd,
And jarring Motions haſt'ning to inactive Reſt.

But *Newton* the unparallel'd, whoſe Name
No Time will wear out of the Book of Fame,
Cæleſtial Science has promoted more, 115.
Than all the Sages that have ſhone before.
Nature compell'd, his piercing Mind, obeys,
And gladly ſhews him all her ſecret Ways;
'Gainſt *Mathematicks* ſhe has no Defence,
And yields t' experimental Conſequence: 120.

His

VERSE 113. *But* Newton *the unparallel'd, whoſe Name*
No Time will wear out of the Book of Fame,
Cæleſtial Science has promoted more,
Than all the Sages that have ſhone before.
Nature compell'd, his piercing Mind, obeys,
And gladly ſhews him all her ſecret Ways;
'Gainſt Mathematicks ſhe has no Defence,
And yields t' experimental Conſequence:
His towring Genius, from its certain Cauſe, &c.

SEE Dr. *Halley*'s Verſes before mentioned

Quæ toties animos veterum torſere ſophorum
Obvia conſpicimus------

Talia

His tow'ring Genius, from its certain Cauſe,
Ev'ry Appearance, *a priori* draws,
And ſhews th' *Almighty Architect*'s unalter'd
Laws.

That *Sol* ſelf-pois'd in *Æther* does reſide,
And thence exerts his Virtue far and wide;

Like

Talia monſtrantem celebrate------
NEWTONUM clauſi reſerantem ſcrinia veri.----
Intima panduntur victi penetralia Cæli-----
-----nubem pellente matheſi,
Quæ Superum penetrare domos, atque ardua cæli,
Scandere ſublimis genii conceſſit acumen.

VERSE 124. *That* Sol *ſelf-pois'd in* Æther *does reſide,*
And thence exerts his Virtue far and wide, &c.

SEE Dr. *Halley*'s Verſes.

Sol ſolio reſidens ad ſe jubet omnia prono
Tendere deſcenſu, nec recto tramite currus
Sidereos patitur vaſtum per inane moveri;
Sed rapit immotis, ſe centro, ſingula gyris.

Like Miniſters attending e'ery Glance,
Six Worlds ſweep round his Throne in Myſtick
Dance.
He turns their Motion from its devious Courſe,
And bends their Orbits by Attractive Force;

His

VERSE 128. *He turns their Motion from its devious Courſe,*
And bends their Orbits by Attractive, &c.

FROM the Laws of *Attraction* (or *Gravity*) Sir *Iſaac Newton* has deduced effects which are found by Obſervation; and nothing beſides the *mathematical Demonſtration* it ſelf) can be a more certain Proof of that *Attraction*, whoſe Laws and Manner of Acting, that incomparable Philoſopher has explain'd, than to find that the Motion of the *Cæleſtial Bodies*, anſwer exactly to the Effects that their mutual *Attractions* muſt produce.

THUS when it had been objected by ſome conſiderable Men againſt Sir *Iſaac Newton*, that it would appear by the Motion of *Jupiter* and *Saturn* in their Conjunction (that is, as they paſs by one another) that *Attraction* was a mere Suppoſition, *Aſtronomers* obſerved thoſe *Planets* in and near the laſt Conjunction with ſo much the more Care, and found that they did ſo affect one another, as they came near, as to diſturb each others Motion, and thereby ſhew their mutual *Attraction*; which Appearance cannot be obſerved in the inferior *Planets*, in reſpect to each other, becauſe they are ſo ſmall, and the *Sun* ſo large and ſo near them, that the Action of the *Sun* on them as He cauſes them to deſcribe their Orbs, makes their Action on each other ſo inſenſible as to eſcape Obſervation.

THIS

His Pow'r, coerc'd by Laws, ſtill leaves them
free, 130.
Directs but not Deſtroys, their Liberty;
Tho'

THIS will be better underſtood, by looking into the Cauſe of the Motion of the *Planets* and *Comets* round the *Sun*, which will be eaſily conceiv'd by any one, that will be at the Pains to read what follows with ſome Attention.

A Body once put into Motion, endeavours to continue in that State of Motion, and would for ever go on in a right Line, never coming to Reſt, unleſs ſome other Force equal to the firſt, or ſeveral Forces (whoſe joint Actions are equal to the firſt Impulſe) do, at once, or ſucceſſively deſtroy its Motion.

A Body thus moving is ſaid to go on with its *projectile* Force, from whoſe rectilineal Direction, it cannot be turn'd to move in a Curve, unleſs there be ſome other Force continually acting to turn it out of the right Line, and the Moment that ſuch a Force ceaſes to act, the Body will fly out of the Curve in a right Line, called a *Tangent* to that Curve.

TO illuſtrate this, let us ſuppoſe a Stone whirl'd round in a Sling before it be thrown forward; we are ſenſible, by the Pull which we feel, that the Stone is endeavouring to fly out of the Curve or Circle wherein we whirl it; and that that Force, with which it endeavours to get looſe, is the greater, the ſwifter the Stone is whirld round. Such a Force is called *centrifugal*, and the Pull of the String which retains the Stone, is called a *centripetal Force*.

LET us ſuppoſe, for Example, that a Stone placed at the Point *A.* (*Fig.* 6.) has an Impulſe given it in the Direction *A B*, but at the ſame Time is held by the String *S A*; inſtead of going to *C*, it will go to *D* in the

Tho' faſt and ſlow, yet regular they move,
(Projectile Force reſtrain'd by mutual Love,)

the Curve *A D O B*. Since the Stone is drawn from *C*, (the Place which the *projectile* Force would have carried it to) to *D*, *D C* will repreſent the *centrifugal* Force, whereby it ſtretches the String in that Direction, and the Force of the String, or *centripetal* Force, which acts in the contrary Direction *C D*, will alſo be equal to the *centrifugal* Force.

Now let *S* repreſent the *Sun*, whoſe *Attraction* is inſtead of the Force of the String abovementioned; and *A* a *Planet*, whoſe Tendency is to move in the Line *AB:* It is evident from what has been ſaid, that if the *Attraction* of the *Sun*, which gives the *Planet* a Tendency towards *S*, be ſo proportioned to the *projectile* Force of the *Planet*, as to carry it to *D*, it will turn it ſtill out of its rectilineal Way, whereby it endeavours to fly off at *D* in the *Tangent D E*, and make it go on to *O*, and then to *B*, and ſo to *A,D*, *&c.* ſo that it ſhall continually deſcribe the Orbit *A D O B*.

If *A D* be an *Arc* of a Circle, of which *S* is the Center, the Curve *A D O B* will be a *Circle*, and the *Planet* will move with equal ſwiftneſs in every Part of the Orbit. But if the *Attraction* had been greater in reſpect of the *projectile Force*, ſo as to draw the *Planet* out of its rectilineal way as far as *d*, then the Curve would have been an *Ellipſe*, or Oval, and the *Sun* would have been in one of its *Foci* (or Centers, as the Workmen call them) and the *Planet* would have deſcribed one half of the Orbit, *(viz.* from the *Aphelion* to the *Perihelion)* with a Swiftneſs or Velocity, uniformly accelerated, and the other half of the Orbit, *(viz.* from the *Perihelion* to the *Aphelion)* with a Velocity uniformly decreaſing.

But this will appear very plain, by looking on the 7th *Figure*, where the *Planet* at *A*, endeavouring to move in the *Tangent Aa*, is by the *Attraction* of the *Sun S*, drawn to *B* inſtead of *M*, at which Point being

And reigning thus with limited Command,
He holds a laſting Scepter in his Hand.

By

nearer the *Sun*, it is more ſtrongly Attracted, and conſequently accelerated; but as the *centrifugal Force*, is proportionable to the Swiftneſs of the Body carried round, the *Planet* endeavours to fly off in the *Tangent B b*, its *centrifugal Force* being increaſed in the ſame Proportion as the *centripetal Force*, or *Attraction* of the *Sun*. The *Planet* being more attracted as it comes nearer the *Sun* at *C*, *D*, and *P*, has alſo proportionably more *centrifugal Force*, ariſing from its encreaſed Velocity; and continually encreaſing its Endeavour to fly off in the *Tangents C c*, *D d*, and *P p*, does thereby eſcape being drawn into the *Sun*.

WHEN the *Planet* which came from *A* [illegible], the *Aphelion*, is got to *P*, the *Perihelion*; it moves through the Points *P*, *E*, *F*, *G*, quite to *A* with a retarded Motion, the *centripetal* and *centrifugal Forces*, equally and gradually decreaſing in the ſame Manner as they encreaſed before: For in this half of the Orbit, the Direction of the *Sun*'s *attractive Force*, is contrary to (or at *obtuſe Angles*, with) the Direction of the *projectile Force*, as appears moſt plainly at the Points *C*, and *F*, *S C* the Direction of the *Sun*'s *Attraction*, making an acute Angle with the *Tangent C c*, when the *Planet* is at *C*; but when the *Planet* is at *F*, *S F* the Direction of the *Sun*'s *Attraction* makes an obtuſe Angle with the *Tangent Ff*, therefore the *projectile Force* in the Direction *Ff*, is leſs than it was in *E e* and *P p*, but greater than in *G g*, or *A a*.

N. B. S *is one Focus of the Ellipſe, and* Z *the other*.

IT is evident, that the longer (or the more *excentrick*) the Ellipſe is, the greater will be the Difference of Velocity. This is not very ſenſible in the *Planets*, whoſe elliptick Orbits differ but little from Circles, but yet enough to fall under Obſervation; for it is owing to this that our Summer is eight Days longer than our Winter; but in Comets, which move in very long Ellipſes, the Motion is incredibly ſwift in the *Perihelion*, and as ſlow proportionably in the *Aphelion*; the Comet which appeared

in

By his Example, in their endleſs Race,
The *Primaries* lead their *Satellites*,
Who guided, not enſlav'd, their Orbits run,
Attend their Chiefs, but ſtill reſpect the *Sun*,
Salute him as they go, and his Dominion
own. 140.

in 1680, and 1681, deſcribing in leſs than a Year, all that Part of its Orbit in which it was viſible to us; though its whole Revolution is not performed in leſs than 575 Years.

> VERSE 137. *The* Primaries *lead their* Satellites,
> *Who guided, not enſlav'd, their Orbits run,*
> *Attend their Chiefs, but ſtill reſpect the* Sun,
> *Salute him as they go, and his Dominion own.*

Saturn, *Jupiter*, *Mars*, the *Earth*, *Venus* and *Mercury*, are called *Primaries*, or *Primary Planets*, becauſe they move round the *Sun*; but the five *Moons*, or *Planets* which move about *Saturn*, and the four which move about *Jupiter*, and the *Moon* which goes round our Earth, as they all attend their *Primaries* in their Revolution about the *Sun*, are called the *ſecondary Planets*, or *Satellites*.

NOW theſe *Satellites* are kept in their Orbits, by the *Attraction* of their *Primaries* and hindered from flying out in a ſtreight *Line* or *Tangent*, in the ſame manner as the *Primaries* are carried round the *Sun*, as has been explain'd

Comets, with ſwiftneſs, far, at diſtance, fly,
To ſeek remoter Regions in the Sky;
But tho' from *Sol*, with rapid haſte, they roll'd;
They move more ſlowly as they feel the Cold;

Lan-

explain'd in the laſt Note. This Motion of the *Satellites* would be entirely regular, were it not for the *Sun*'s *Attraction*, which (though it is not near enough to hinder them from going round their *Primaries*) diſturbs their Motions; as is very evident in the *Moon*, which moves with more or leſs Velocity, and whoſe Orbit becomes more or leſs Convex according to its Poſition in reſpect of the *Sun*: And that ſeeming Irregularity of the *Moon*, is ſo various and intricate that no Body could invent any tolerable *Hypotheſis* to ſolve it, or Numbers to expreſs it, till Sir *Iſaac Newton* demonſtrated every Appearance and Motion of that variable *Planet* to be the Effect of the mutual Attraction of the *Sun*, *Earth*, and *Moon*, according to the different Poſitions of theſe three Bodies. See Dr. *Halley*'s Verſes, before Sir *Iſaac Newton*'s *Principia*.

> Diſcimus hinc tandem, quà cauſa argentea Phœbe,
> Paſſibus haud æquis graditur, cur ſubdita nulli
> Hactenus Aſtronomo numerorum frœna recuſet.

VERSE 141. *Comets, with ſwiftneſs, far, at diſtance, fly,*
To ſeek remoter Regions in the Sky.
But tho' from Sol, *with rapid haſte, they roll'd,*
They move more ſlowly as they feel the Cold;

Languid

Languid, forlorn, and dark, their State they
moan, 145.
Deſpairing when in their *Aphelion.*
But *Phœbus,* ſoften'd by their Penitence,
On them benignly ſheds his Influence,
Recalls the Wanderers, who ſlowly move
At firſt, but haſten as they feel his Love: 150

Languid——————————
——————————*in their* Aphelion.

As Comets move from their *Perihelion* (or their neareſt Place to the *Sun* in their Orbit) to the *Aphelion* (or greateſt Diſtance from the *Sun,*) they begin their Motion with great Celerity, but go on ſlower and ſlower till they come to the *Aphelion,* from whence their Motion continually increaſes till they come back to the *Perihelion*; juſt as a Cannon Ball ſhot upwards, being attracted by our Earth, moves ſlower and ſlower, till it be got up to its utmoſt Height, from whence it decends with an accelerated Motion. See the laſt Note but one, where we have explain'd the Motion of a Comet.

To him for Mercy bend, ſue, and prevail;
Then Atoms crowd to furniſh out their Tail.
By *Newton*'s help, 'tis evidently ſeen
Attraction governs all the World's Machine.
But now my cautious Muſe conſider well 155.
How nice it is to draw the Parallel:

Nor

VERSE 151. *To him———bend———prevail;*
Then Atoms crowd to furniſh out their Tail.

As Comets begin to come near the *Sun*, their Orbit which was almoſt in a right Line, bends very quick; and as they approach the *Sun* its great Heat makes the Comet throw out a Vapour, or Exhalation in great Quantity, which Vapour is always carried in a Direction oppoſite to the *Sun*, and being ſhin'd upon by the *Sun*, gives a View of what is called the Comets Tail,' which Tail is of a prodigious Length, juſt after the Comet had paſſed the *Sun*, if the Comet went very near it; as happen'd to the Comet ſeen in 1680, and 1681, which paſſed ſo very near the *Sun*'s Surface as to receive a Degree of Heat 2000 times greater than our culinary Fires (or Iron when it is red hot) and to throw out a Tail as long as the Diſtance from the *Earth* to the *Sun*, which is above 80 Millions of Miles.

As

Nor dare the Actions of crown'd Heads to ſcan:
(At leaſt within the Memory of Man)
If th' Errors of *Copernicus* may be
Apply'd to ought within this Century, 160.
When e'er the want of underſtanding Laws,
In Government, might ſome wrong Meaſures cauſe,
His Bodies rightly plac'd ſtill rolling on,
Will repreſent our fix'd Succeſſion,
To which alone th' united *Britons* owe, 165.
All the ſure Happineſs they feel below.

Nor

As the Comet recedes from the Sun, its apparent Magnitude decreaſes, till at laſt both Comet and Tail become inviſible, when they are about as far from us as *Jupiter*, but ſtill we muſt make allowance for the bigneſs of the Comet, ſome being nearly as big as the Earth, and others very little bigger than the *Moon*.

Nor let the Whims of the Carteſian Scheme,
In Politicks be taken for thy Theme,
Nor ſay that any Prince ſhou'd e'er be meant,
By *Phœbus*, in his *Vortex*, indolent,
Suff'ring each Globe a *Vortex* of his own,
Whoſe jarring Motions ſhook their Maſter's Throne,
Who governing by Fear, inſtead of Love,
Comets, from ours, to other Syſtems drove.
But boldly let thy *perfect Model* be,
NEWTON's (the only true) *Philoſophy*:
Now ſing of Princes deeply vers'd in Laws,
And Truth will crown thee with a juſt Applauſe;
Rouſe

VERSE 174. *Comets, from ours, to other Syſtems drove.*

SEE the Note on *Verſe* 94, concerning *Carteſius*'s Account of Comets.

Rouſe up thy Spirits, and exalt thy Voice
Loud as the Shouts, that ſpeak the People's
Joys; 180.
When MAJESTY diffuſive Rays imparts,
And kindles Zeal in all the *Britiſh* Hearts,
When all the Powers of the Throne we ſee
Exerted, to maintain our *Liberty*:
When Miniſters within their Orbits move, 185.
Honour their King, and ſhew each other Love:
When all Diſtinctions ceaſe, except it be
Who ſhall the moſt excell in Loyalty:
Comets from far, now gladly wou'd return,
And, pardon'd, with more faithful Ardour
burn. 190.

ATTRACTION now in all the Realm is ſeen,
To bleſs the Reign of GEORGE and CAROLINE.

* * *

LEAP-

LEAP-YEAR:

OR,

Cambria's Complaint

Againſt the

INTERCALARY DAY.

THREE Winters *Cambria* had with Plea-
ſure view'd,
How *Rhedycina*'s learned Pillars ſtood;

VERSE I. *Three Winters* Cambria *had with Pleaſure view'd*
How Rhedycina'*s learned Pillars ſtood.*

Cambria (Wales) is ſuppoſed to have been viewing the Draughts in the *Oxford* Almanacks for the three laſt Years, and now to be caſting her Eyes on what is repreſented in the Almanack for this Year 1728, before She looks for *Her* MAJESTY's Birth-Day in the Calendar below.

Wolſey's and *Fox*'s Domes rejoyc'd to ſcan;
And pitied *Lancaſter*'s unfiniſh'd Plan.
As Seaſons roll'd ſhe ſaw with gladſome Eyes
Beſide great *Chichley*'s Walls new Wonders riſe:
Bounty and Art at once engag'd her Mind,
How *Codrington* beſtow'd, and *Clark* deſign'd.
Hard by ſhe ſpied young *Henry*, as he ſate,
By Guards ſurrounded, in his Chair of State;

Of

VERSE 3. Wolſey *and* Fox*'s Domes* ———

Chriſt-Church *and* Corpus Chriſti *Colleges.*

VERSE 4. *And pitied* Lancaſter's *unfiniſh'd Plan.*

Queen's College, whoſe Plan was contrived, and in Part executed by the late Dr. *Lancaſter*; but left unfiniſhed for want of ſufficient Benefactions.

VERSE 6. ———*New Wonders*———

The new Buildings at All-Souls College.

VERSE 9. ———*young* Henry ———

King *Henry* the Sixth, who granted Archbiſhop *Chichley* the Patent for founding *All-Souls* College, and the ſaid Archbiſhop, are drawn in the *Oxford* Almanack for the preſent Year.

Of warlike Sire a weak unactive Son,
Who hapleſs loſt more than her *Monmouth* won.
Long ſhe beheld, as long as ſhe could ſpare
Her Thoughts intent upon a nearer Care;
Then of the charming Piece her Leave ſhe took, 15.
And underneath it caſt a wiſtful Look;
Eager to trace how ſoon the Morn wou'd ſhine,
Sacred to *DAVID* and to CAROLINE.
But with what Rage poſſeſs'd, when in the Way
She found a ſupernumerary Day! 20.

Frowning

VERSE 20. *She found a ſupernumerary Day.*

According to the *Julian Account*, which we obſerve in *England*, the 24*th* Day of *February* is reckoned twice in the *Biſſextile* or *Leap-Year*, which makes that Month to have 29 Days, and changes the *Dominical* (or *Sunday*) Letter. —— Whereas in other Years *February* has but 28 Days, and the *Dominical* Letter continues the ſame during the whole Year.

Frowning, the Goddeſs rais'd her awful Head,
And with becoming Paſſion thus ſhe ſaid.

Impertinent of Days, what doeſt thou here,
More to diſturb, than to adjuſt the Year?
Puzzling *Matthias*, whether he ſhall keep 25.
His wonted Station, or conſent to *Leap*.
And were this all, I cou'd with this diſpenſe,
But not with that audacious Inſolence,
Which ſhoves *Menevia*'s Prelate farther down,
And braves the beauteous Conſort of the Crown. 30.

Whilſt

VERSE 25. *Puzzling* Matthias.

The *Oxford* Almanack and ſome others make the 25*th* of *February* to be St. *Matthias*'s Day this *Biſſextile* Year; whilſt the reſt of the Almanacks make it the 24*th*.

VERSE 29. ——Menevia——

The City of St. David'*s in* Wales.

Whilſt my dear *Britons* dutifully ſeek
With Pains to cultivate the fragrant Leek,
And flowing Bowls prepare to hail their Queen,
Thou, ſacrilegiouſly, ſtepp'ſt in between.
If we to ſage Aſtronomers ſhould yield, 35.
That theſe Intercalations muſt be held;
Cou'd blooming *April* not afford thee Place,
Or cou'dſt thou not creep in at *Michaelmas?*
Well had'ſt thou clos'd the Month that follows *May*,
And giv'n the *Sunday* Letters equal Play: 40.

Or,

VERSE 37. *Cou'd blooming* April ——————
———————————— *Michaelmas,*
————————*the Month that follows* May.
————————————Scotia's *Saint.*

April, June, September, and *November* having only 30 Days each, any one of them might have received the *Intercalary* Day, and our *Leap-Years* have continued the ſame, as to the Way of reckoning.

Or, rather than my Fav'rite to ſupplant,
Well had'ſt thou waited upon *Scotia*'s Saint.
As *Scotia*, with her Hardſhips finding Fault,
Inſtructs her Sons to watch the Tax on Malt;
Mine againſt thee a worſe Complaint ſhall bring,
Attentive to my Voice, while thus I ſing.

When Ignorance prevail'd, in Times of old,
Popes had with living Emperors been bold:
In a more knowing Age *Gregorius* bred
Eſteem'd it ſafer to attack the Dead;

Of

VERSE 49. ————Gregorius———————
—— ——*mend the Errors of the* Julian *Style.*

The *Julian Style* derives its Name and *Inſtitution* from *Julius Cæſar*: He obſerving the *Egyptian Year* to get before the *Tropical*, or *Natural Year*, becauſe the 6 Hours it wants of the *Tropical* are intirely neglected in its *Conſtitution*,

Of long-worn Lawrels *Cæſar*'s Brows to ſpoil,
And mend the Errors of the *Julian* Style.

ſtitution, did therefore add thoſe 6 Hours to each *Julian Year*; ſo that a *Julian Year* conſiſts of 365 Days, 6 Hours; and becauſe this Quarter of a Day can't be conſider'd or taken Notice of in *Civil* Uſe, he order'd the 6 Hours to be neglected till they made a Day, which happening every fourth Year, was to be inſerted, by Way of *Intercalation*, between the 23*d* and 24*th* of *February*; therefore from that time they write the Sixth of the *Calends* of *March* twice, from which the *Year* had the Name of *Biſſextile*. But as to this *Julian Year*, the Quantity of it muſt be own'd to be too big, on which Account, the Beginning of this *Year* alſo, by little and little, creeps forwards in regard of the *Seaſons*, or (which is all one) the times of the *Equinoxes* and *Solſtices* go backward in regard of the Days of this *Year*. And ſince this Regreſs is about $10\frac{4}{5}$ Minutes every Year, in about 133 Years it will be about a Day, and conſequently from the *Year* of *Chriſt* 325, wherein the *Council* of *Nice* was held, to the *Year* 1582, wherein Pope *Gregory* reform'd the *Calendar*, this Regreſs amounted to 10 Days. Hence it came to paſs, that whereas in the time of the *Nicene Council*, the *Vernal Equinox* happened near about the 21*ſt* of *March*; in the Year 1582, it was found to be about the 11*th* of *March*: That he might therefore bring the *Equinox* to its former Place, 10 Days were ſuppreſs'd in the Month of *October*, in the *Year* 1582, and the 5*th* Day was call'd the 15*th*; by this means, what would otherwiſe have been the 11*th* of *March* following, becomes the 21*ſt* of *March*; that is, the *Equinox* happens the ſame Day as it did in the time of the *Council* of *Nice*. And that the like *Variation* might not happen again, the ſaid *Pope* order'd, that once in 133 *Years*, a Day ſhould be taken out of the *Calendar*, or (which comes to the ſame) that three Days ſhould be taken out every *four hundred Years*; and this he appointed to be done, by making every *hundredth Year* of the *Chriſtian Æra* common; which, according to the *Julian Account*, is always *Biſſextile*, but every *four hundredth Year* to continue *Biſſextile*, as in the *Julian Account*. This Form of the Year, ſettled by Pope *Gregory* XIII. was call'd from him the *Gregorian*, and is obſerved

Five Solar Cycles are but lately run,
Since firſt the Pontiff's New Account begun;
Since proud *October* came, and vain of Praiſe, 55.
Boaſted his Num'rous, tho' Declining Days,
His Foot ſcarce fix'd when he was ſmitten low,
Stunn'd with the Weight of a deſtructive Blow.

Ten

---

in *Italy*, *France*, *Spain*, *Germany*, and whereſoever the *Authority* of the *Pope* did then reach. In the Year 1700, which was *Biſſextile* with us in *England*, the *Intercalary Day* was left out by thoſe that uſe the *Gregorian Account*, which made it a common Year, and cauſes their preſent Reckoning to be 11 Days before ours.

VERSE 53. *Five Solar Cycles*————

The Cycle of the Sun is 28 Years, and it is now 146 Years ſince the *Gregorian Account* begun.

VERSE 55. ————*proud* October ————

See the laſt Note but one.

Ten Sacred Worthies fell; ſo *Rome* deſpis'd,
So dropp'd the Honours of the Canoniz'd. 60.
The fatal Stroke *Calixtus* overtook,
And *Francis* might almoſt ſhake Hands with *Luke*:
Unnumber'd Birth-Days off at once were ſwept,
And many a Wedding-Night ſlipp'd by unkept.
Had ſuch a Chaſm of Time with us been made, 65.
Bleſs'd, as we are, with Opulence and Trade;

VERSE 59. ——— *Ten ſacred Worthies fell* ———

The *Romaniſts* having Saints or Worthies for every Day, the Ten who paſs unobſerv'd that Year from the 5*th* to the 14*th* of *October*, were theſe, St. *Placidus*, St. *Bruno*, St. *Marc* the Pope, St. *Bridget*, St. *Dennis*, St. *Paulinus*, St. *Veniens*, St. *Nicaſius*, St. *Geraldus*, and St. *Calixtus*.

VERSE 62. *And* Francis *might almoſt ſhake Hands with* Luke.

St. *Francis* on the 4*th*, and St. *Luke* on the 18*th* of *October*, by the ſinking of 10 Days, were brought within 3 Days of one another.

How ſorely had we felt our ſelves diſtreſs'd
In Landed and in Money'd Intereſt?
Bills, Bonds and Leaſes wou'd have ſhifted Date,
" Affording Matter ſtrange for Law-Debate; 70.
Tenants had murmur'd at Approach of Rent,
And all our Stocks had varied Two *per Cent.*

Fain wou'd I act with Caution, and with Eaſe
To ſcrupulous and tender Conſciences;
Fain make a Reconciling Step to *Rome*, 75.
Yet not bring back a Rag of Pop'ry home;
One Common Form of Reck'ning introduce,
But leave the Toleration ſtill in Uſe.

Haſte

VERSE *76. Yet not bring back a Rag of Popery home.*

The *Roman* and *Engliſh* Style may certainly be reconcil'd, without any Danger of imbibing any *Popiſh* Doctrines in Religion.

Haſte then, my Patriots, to your Seats repair,
And when aſſembled in full Numbers there, 80.
Reſolve, without one contradicting *Nay*,
To wreak my Vengeance on this Trayt'rous Day;
Strictly oblige the Wretch to diſappear,
Proſcrib'd and baniſh'd from the *Britiſh* Year.
Yet let him ſtill have Juſtice mix'd with Grace, 85.
And, proper Penance done, reſume his Place.
Let no *Biſſextile* here be ſeen again,
'Till GEORGE has equall'd Great ELIZA's
Reign.

This

VERSE 88. *'Till GEORGE has equall'd great ELIZA's Reign.*

If his preſent MAJESTY reigns as long as Queen *Elizabeth*, that is 44 Years, and there be no Leap-Years in that Time, our Reckoning will advance 11 Days, and bring our Style to agree with the *Gregorian*: And if his MAJESTY reigns longer, as our boundleſs Wiſhes may make us hope, he will (if our Expedient be allow'd of) live to ſee the ſame STYLE made uſe of over all the *Chriſtian* Part of *EUROPE*.

This will inſenſibly compoſe the Jars
Betwixt the Two contending Calendars.
And may our Aims, to make *their* Quarrel ceaſe,
Prove a ſure Omen to *Europa*'s Peace.

FINIS.

Advertiſement.

COURSES of EXPERIMENTAL PHILOSOPHY, and Courſes of EXPERIMENTAL ASTRONOMY, *publick* or *private*, in *Latin*, *French*, or *Engliſh*, are perform'd at any Time of the Year, and likewiſe all Parts of *pure* or *mix'd Mathematicks* taught, by the *Author*, at his Houſe in *Channel-Row*, *Weſtminſter*; where Gentlemen, who have a Mind to apply cloſe to theſe Studies, may be boarded.

The Author here thinks proper to acquaint thoſe Perſons, who have ſubſcribed ſome Time ago for his Courſe of Experimental Philoſophy, in Two Volumes in Quarto, *&c. that he has been for Two Years laſt paſt prevented from going on with the Work by unavoidable Diſappointments, not proper to be mention'd here; but that he has now reſumed the Work, and will finiſh it with all Expedition.*

The *Reader* is deſir'd to correct the following

ERRATA.

PAGE 2. line 5. for *their* read *the*. P. 6. line 24. for *though* read *thought*. line 27. for *the* read *two*. P. 7. line 12. for *comes* read *come*. P. 12. line penult. for *K* read *k*. P. 22. line 12. for *acumem* read *acumen*. P. 23. line 9. for *nothing beſides* read *nothing (beſides*. P. 25. line 15. for *to AD* read *to A, D*. P. 26. line 12. for *from AP* read *from A*.

The Copernican or true Syſtem of the World

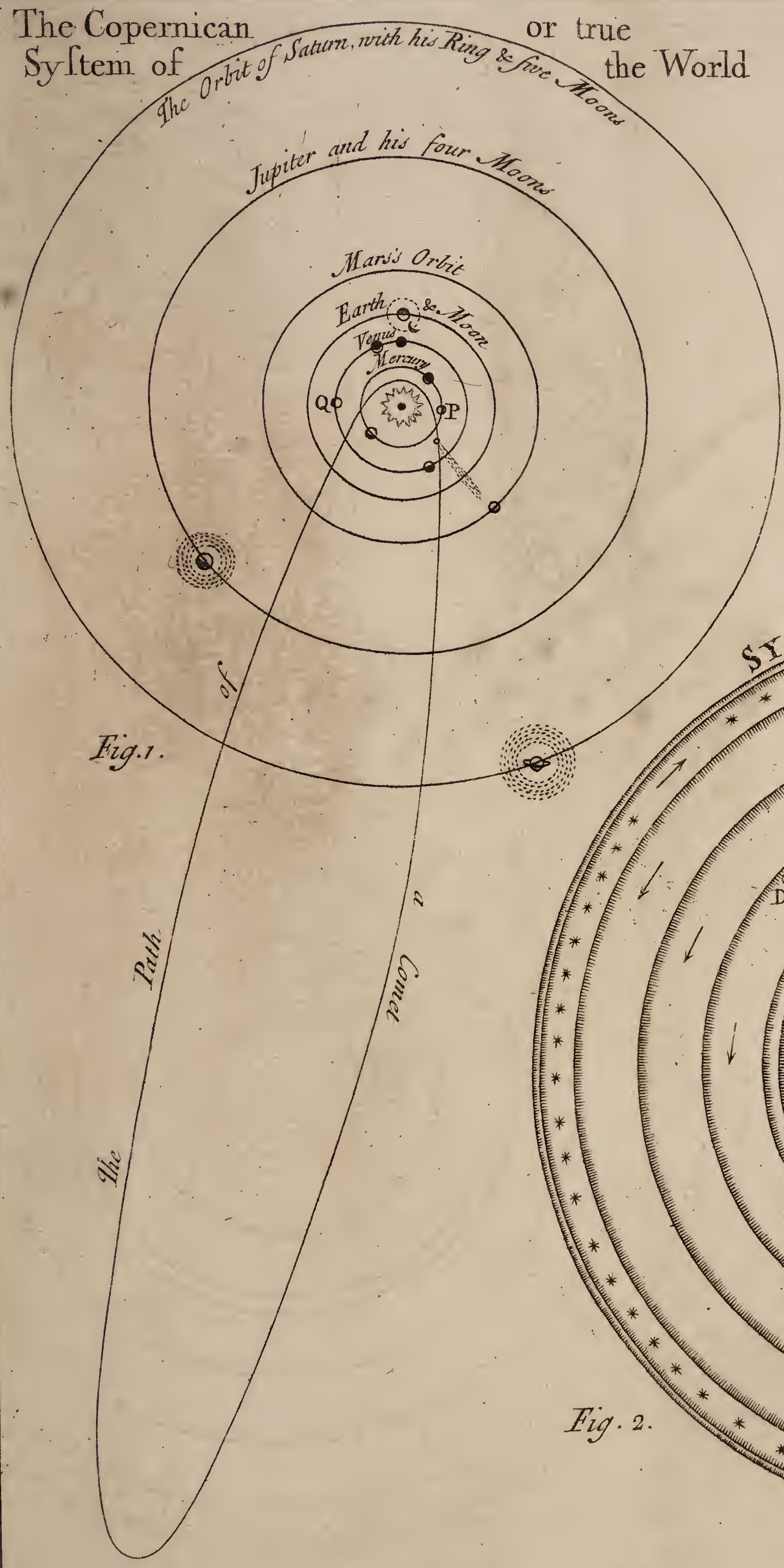

The Orbit of Saturn, with his Ring & five Moons
Jupiter and his four Moons
Mars's Orbit
Earth & Moon
Venus
Mercury
Q
P
The Path of a Comet

Fig.1.

Syſtem of Tycho Brahe

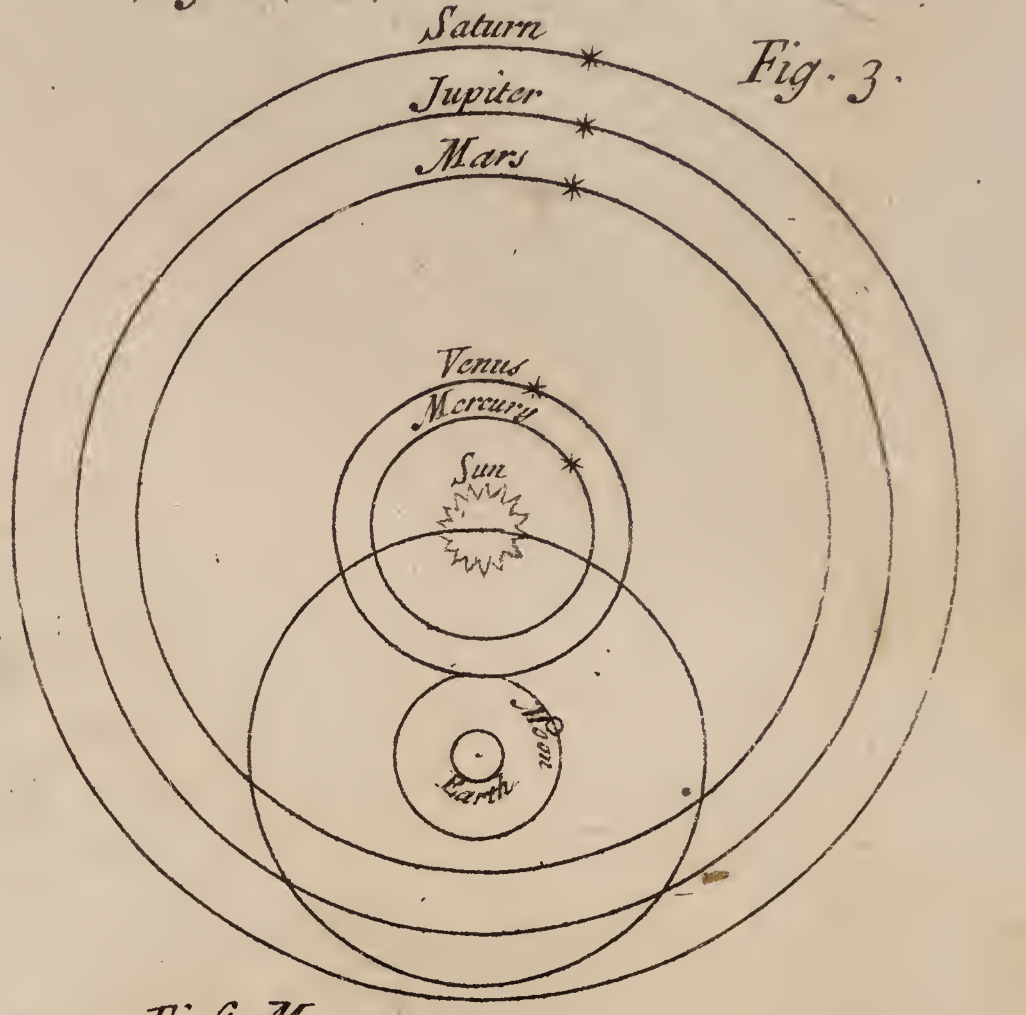


Fig. 3.

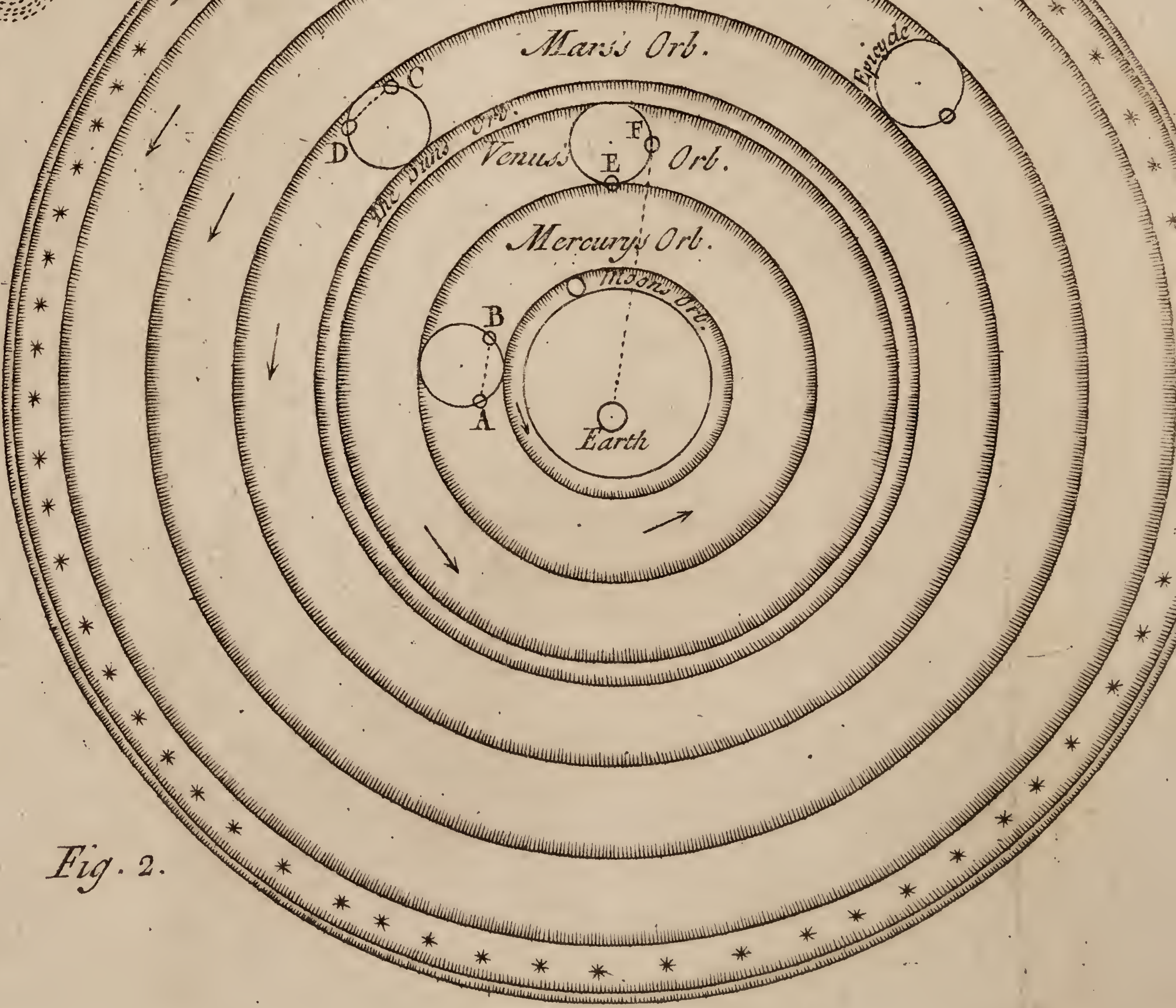


Fig. 2.

Fig. 4.

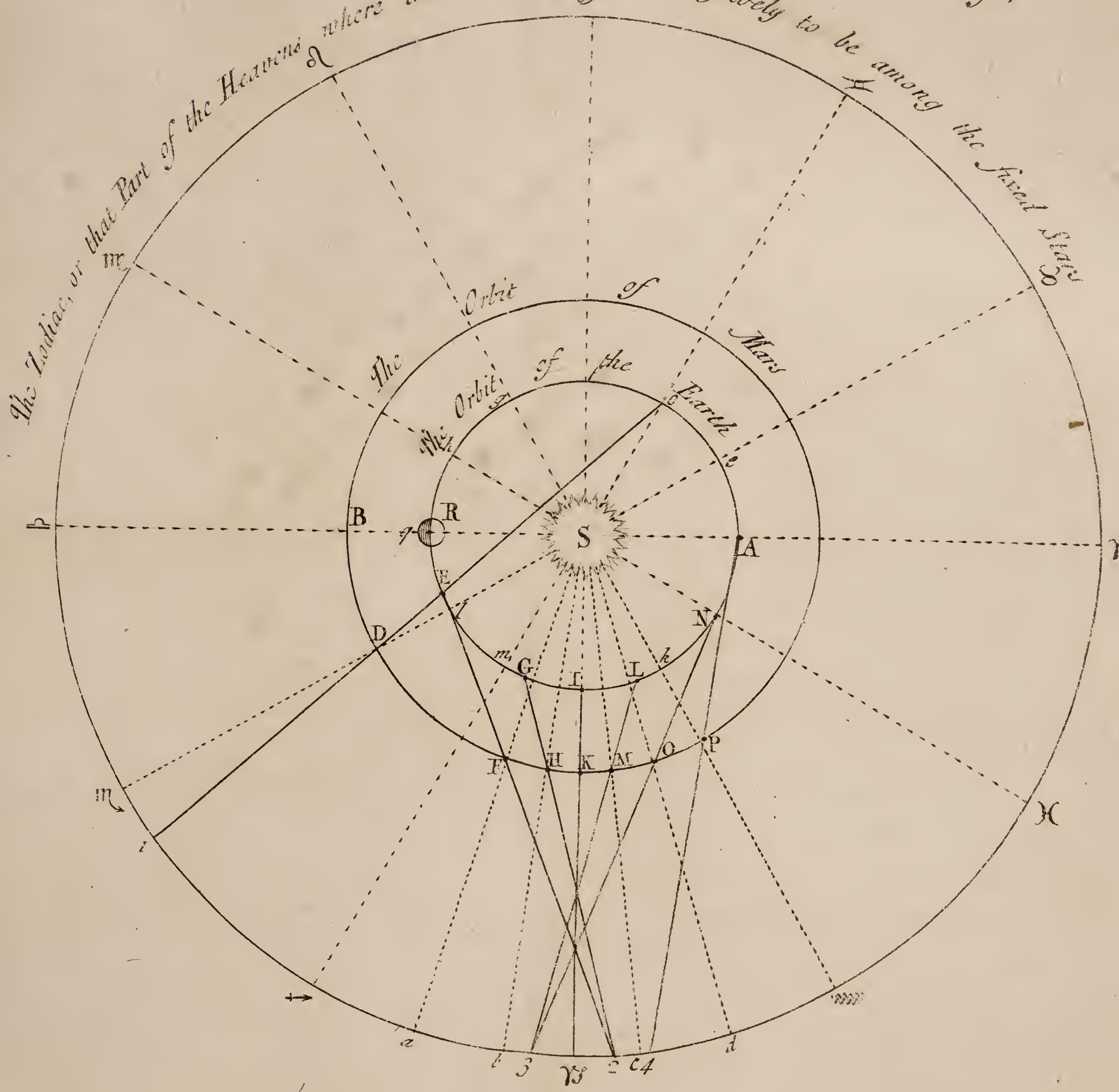

The Zodiac, or that Part of the Heavens where the Planets appear successively to be among the fixed Stars
The Orbit of Mars
The Orbit of the Earth
♋
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Fig. 5

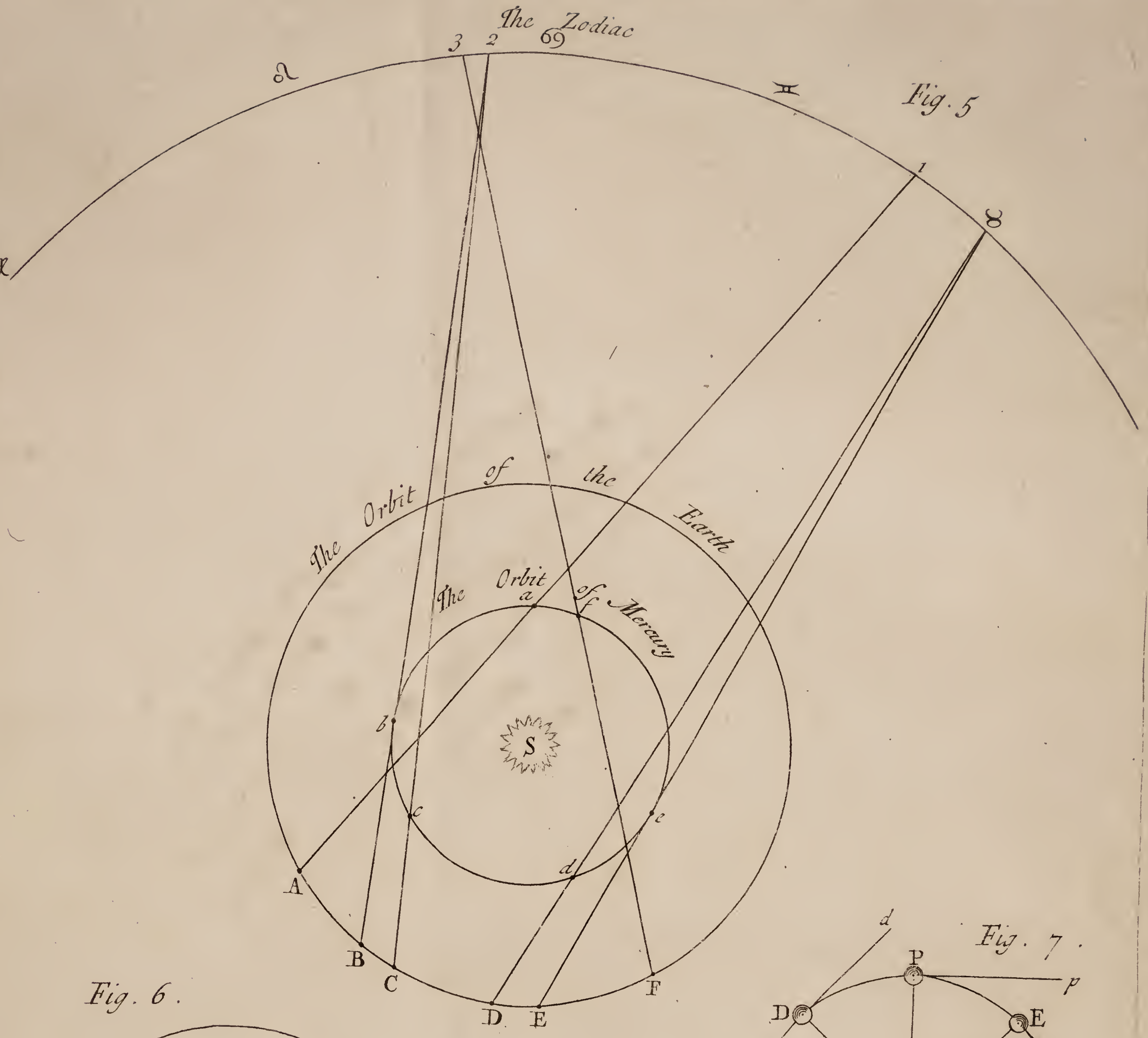

Fig. 6.

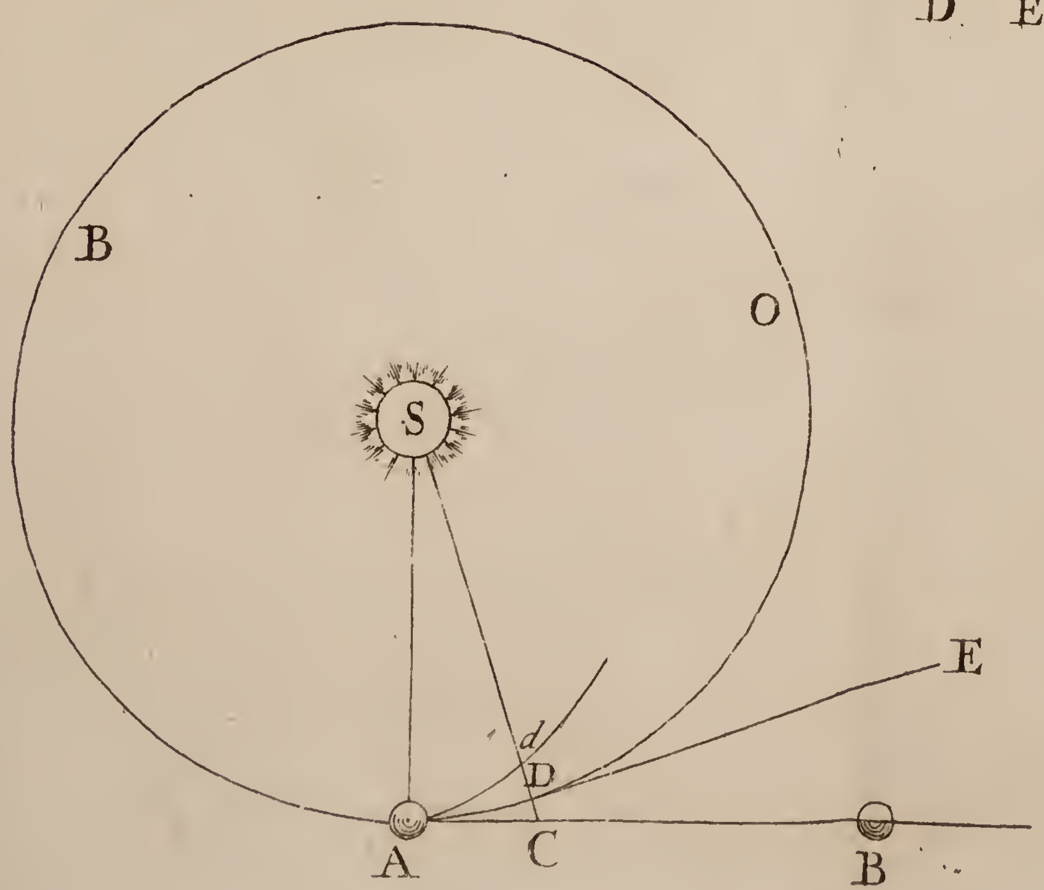

Fig. 7.